THE ATLANTIC WATER IN THE LEVANTINE BASIN (1995-2006)

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Abstract
New in-situ data sets obtained from different observing platforms between 1995-2006, within the framework of the CYBO, CYCLOPS, HaiSec projects and the CYCOFOS observing system, provide the most recent evidence about the spatial and temporal displacement of the Atlantic Water (AW) and of the Mid-Mediterranean Jet (MMJ) in the Levantine Basin. These data confirm that the MMJ is an offshore cross-basin flow transferring the AW, as it was first depicted in 80s within the framework of the Physical Oceanography of the Eastern Mediterranean (POEM) experiment.
Keywords : Water Transport, Circulation, Levantine Basin.

Preface
The most variable water mass of the Eastern Mediterranean Levantine Basin is the surface and subsurface Atlantic Water (AW). The inflow of the AW in the Mediterranean is the result of the water volume compensation for the high rates of sea water evaporation in the Levantine Basin and the outflow of Levantine Intermediate Water (LIW) into the North Atlantic [1]. The AW, after its entry into the Mediterranean through the Gibraltar, spreads as far east as the Levantine Basin. The general circulation in the Eastern Mediterranean as inferred in the 1960s and 70s [1] shows an anticlockwise flow with sub-basin features in the Levantine basin. In the 80s, during the Physical Oceanography of the Eastern Mediterranean (POEM) mesoscale field experiments [2,3], it was documented that AW is transferred within the Levantine by the MMJ. This offshore cross-basin jet is generated as a result of the interaction between the cyclonic (Rhodos gyre) and the anticyclonic (Mersa Matruch and Shikmona gyres) flow features during the eastward spreading of the surface and subsurface waters of Atlantic origin, after passing the Cretan passage.

Discussion and results
The seasonal and inter-annual variability of the AW distribution in the Levantine Basin, particularly in its south-eastern part, is examined based on new in-situ data collected during the Cyprus Basin Oceanography (CYBO), Cycling of Phosphorous in the Mediterranean (CYCLOPS) and HaiSec (Long-term Haifa Section) projects, carried-out between 1995-2006 [4]. Moreover, high frequency in-situ data were collected in the near surface layer from the Cyprus Coastal Ocean Forecasting and Observing System (CYCOFOS) ocean observatory, from 2004 to 2006. These data sets highlight the spatial and temporal variability of the AW in the region, while in addition provide strong evidence about the existence of the Mid-Mediterranean Jet (Fig.1). During the summer periods studied (1995-2006) the minimum salinity layer, attributed to AW, is well defined at a depth of about 40-50 m (below the seasonal thermocline) and with a value as low as 38.65-38.75 (Fig.1). During winter (as in January 1999) it can be found with similar or higher salinities. However, during severe winter weather conditions the presence of AW is difficult to trace, and is most likely modified due to strong winter mixing processes. The AW, transferred by the MMJ along the northern periphery of the Cyprus warm core eddy, is most well defined southwest and south of Cyprus. However, AW has also been observed close to the Egyptian coast, as a result of a westward re-circulation (Fig.1). In-situ data from the CYCOFOS ocean observatory, located in the open deep sea southwest of Cyprus, provide unique evidence for the high frequency (half-hourly) variability of AW in this particular area. The MMJ is considered to be the main flow pathway for transferring AW eastward within the Levantine Basin. From June through October 2004, the 38 m sensors indicate the presence of AW. The salinity at this depth was nearly always below 38.8, whereas the salinity in the upper layer (17m) was greater than 39. In winter 2004-2005, the mixed layer deepened beyond the deepest (38 m) sensor. Salinities in the mixed layer were greater than 39. From May to June 2005 the salinity at 38 m showed again the intrusion of the AW with values fluctuating between 38.8-38.98. The sensors at the depth of 17 m showed the salinity to increase gradually during the same period, reaching values greater than 39.

The analyses of these new in-situ data sets collected from different observing platforms, with different sampling time and spatial scales, provide strong new evidence that the MMJ transfers the main volume of the AW in the SE Levantine basin. These new data confirm that the MMJ, after crossing the basin from the offshore southwestern part of the Levantine, meanders eastward between offshore Cyprus and the northern periphery of the Cyprus warm core eddy or the Shikmona gyre (when present). Moreover, at a certain times the in-situ data closer to Egypt provided evidence of a westward re-circulation off the coast of Egypt.

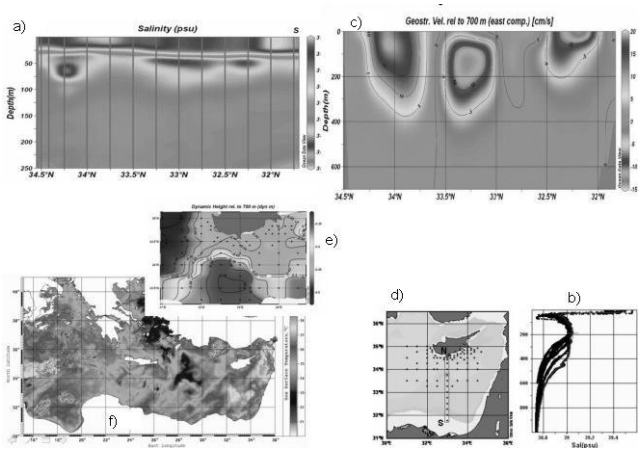

Fig. 1. Salinity section (a), salinity profiles (b) and geostrophic velocities (c) along the N-S Cyprus- Egypt section (d) in early September 2005, show the AW and the MMJ in the study area. The dynamic height topography (e) and SST image (f) show the prevailing flow patterns during the same study period.

References

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